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PNW Climate Impacts Group

Climate Science in the Public Interest

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Climate Science in the Public Interest

Climate Impacts Group (CIG)

- 1st of 8 U.S. regional integrated assessment teams (RISAs). CIG's focus is on the Pacific Northwest.

- Established in 1995
- Based at the University of Washington (Seattle) with collaborations in Oregon and Idaho
- Funded largely by the National Oceanic and Atmospheric Administration (NOAA/OGP)
  - Additional technical and financial support provided by the University of Washington

The Climate Impacts Group

OBJECTIVES

- Increase regional resilience to the impacts of climate variability and change
- Produce science useful to the decision-making community

SECTORS

- Water Resources
- Forests
- [Human Health]
- Aquatic Resources
- Coasts
- [Agriculture]

SCOPE of WORK

Climate Variability

- past variations and their impacts
- ability of institutions to respond to extremes

Climate Change

- regional consequences of global warming
- adaptation/vulnerability to climate change

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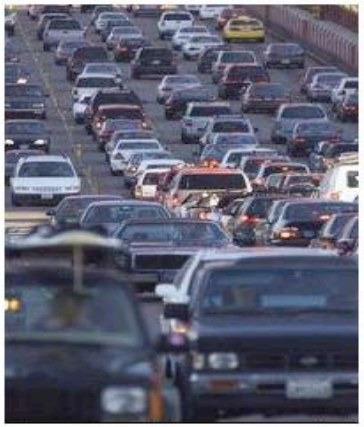
Issues Defining Decision Support Needs in the Pacific Northwest

- Water supplies
  - Heavy reliance on winter snowpack
  - Limited reservoir storage capacity
  - Multiple conflicting demands during summer low-flow season
  - Vulnerability to droughts (region-wide) and winter flooding (west of the Cascades)
- Endangered species
  - Important economically and culturally (tribal rights)
  - Listed species in coastal, rural, and urban areas
  - Fish compete with hydropower, irrigation, and M&I water needs
  - Protection requires reshaping water, land management choices

Issues Defining Decision Support Needs in the PNW (cont'd)

- Forests
  - Important (but declining) part of PNW economy
  - Interior forests vulnerable to wild fire
  - High existence and ecosystem service values

- Coasts and Estuaries
  - Development pressures on coastal wetlands and shorelines
  - Water pollution impacts on local estuaries (impacts on endangered species and shellfish industry)



- Population
  - Rapid population growth (recent and forecasted) in western WA and OR
  - Development pressures on sensitive areas

Methods: Integrated Research

1. Understand the **natural system**

   predictability, uncertainty

2. Understand the **managed system**

   the nature and consequences of human choices and activities

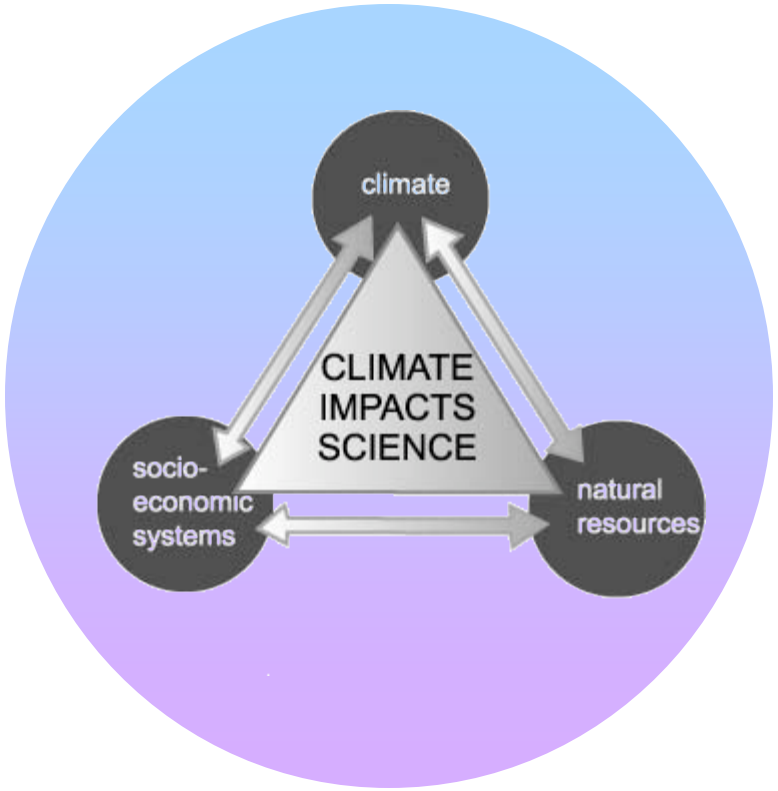
3. Understand the **institutional context** of these systems

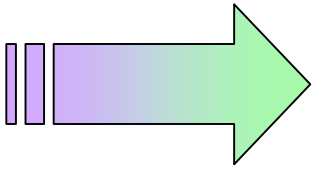
   processes, laws, constraints, decision calendars

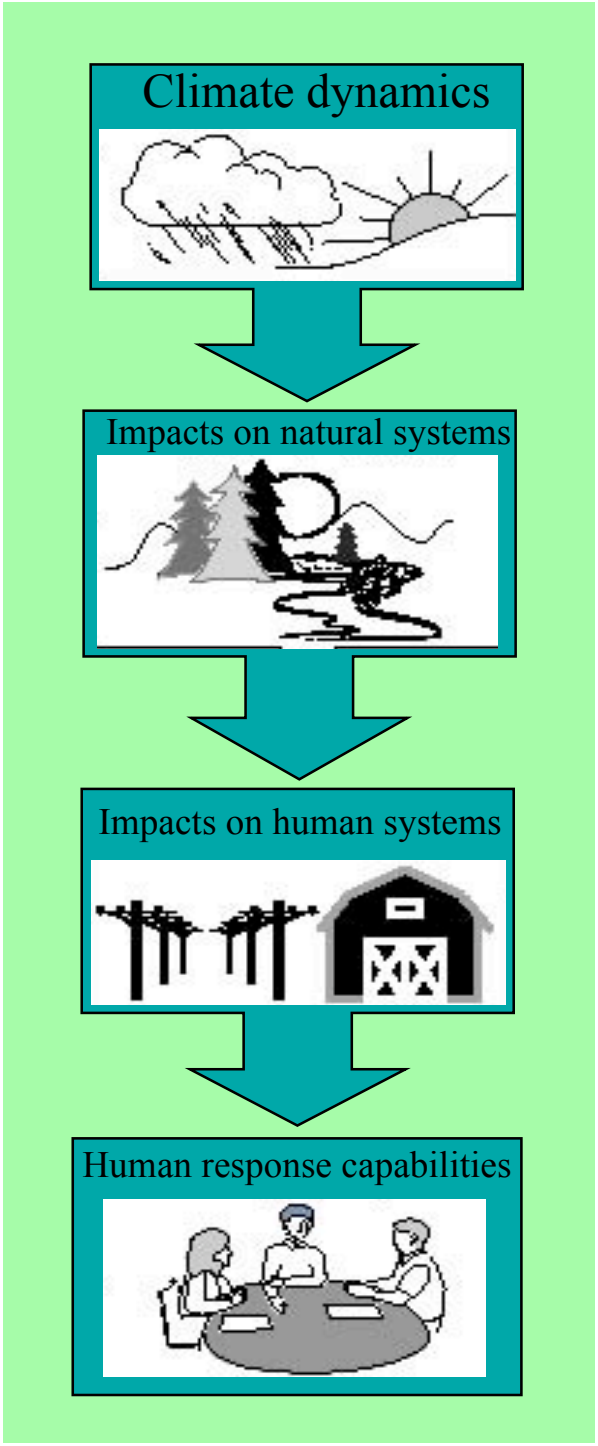
1-3. Work with regional **stakeholders**

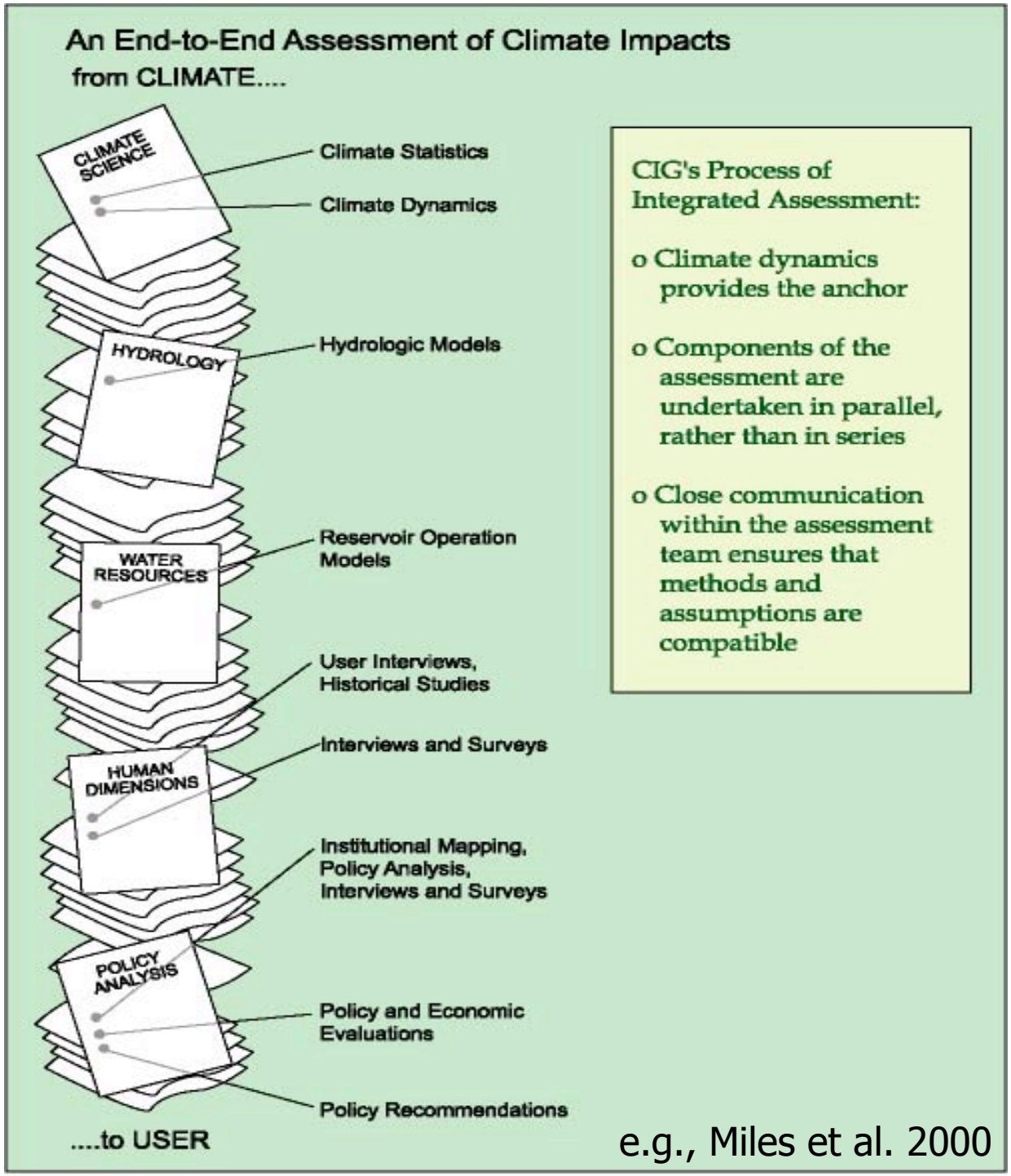
First vertical, then horizontal assessment

Vertical Integration









e.g., Miles et al. 2000

Research: Contributions to Climate Impacts Science

- Defining the Pacific Decadal Oscillation (PDO)
- Identifying ENSO and PDO impacts on PNW winter climate and key natural resources
- Identifying 20th century trends on PNW temperature, precipitation, and snowpack
- Extending the PNW paleorecord (climate, streamflow, forests, Strait of Juan de Fuca SSTs)
- Defining and evaluating the potential impacts of global climate change on PNW climate and resources
- Identifying barriers to effective use of climate information and characteristics of adaptive institutions

Decision-Support Tools: Climate Variability

Designed to help with management on seasonal to interannual time scales. Main products and services:

- Seasonal climate outlook
- Long-lead (1 year) climate-based streamflow forecasts
- Six-month lead time reservoir forecasts tools (under development)
- Oregon Coastal Coho salmon survival forecasts
- Extreme weather risk forecasting
- Office of the Washington State Climatologist

Case study: Evolution of climate information for salmon management

- A fishery oceanography study identifies a *climate impact*

  Climate variability explains a large fraction of the space-time variations in 20th Century Pacific salmon catches (and presumably abundance)

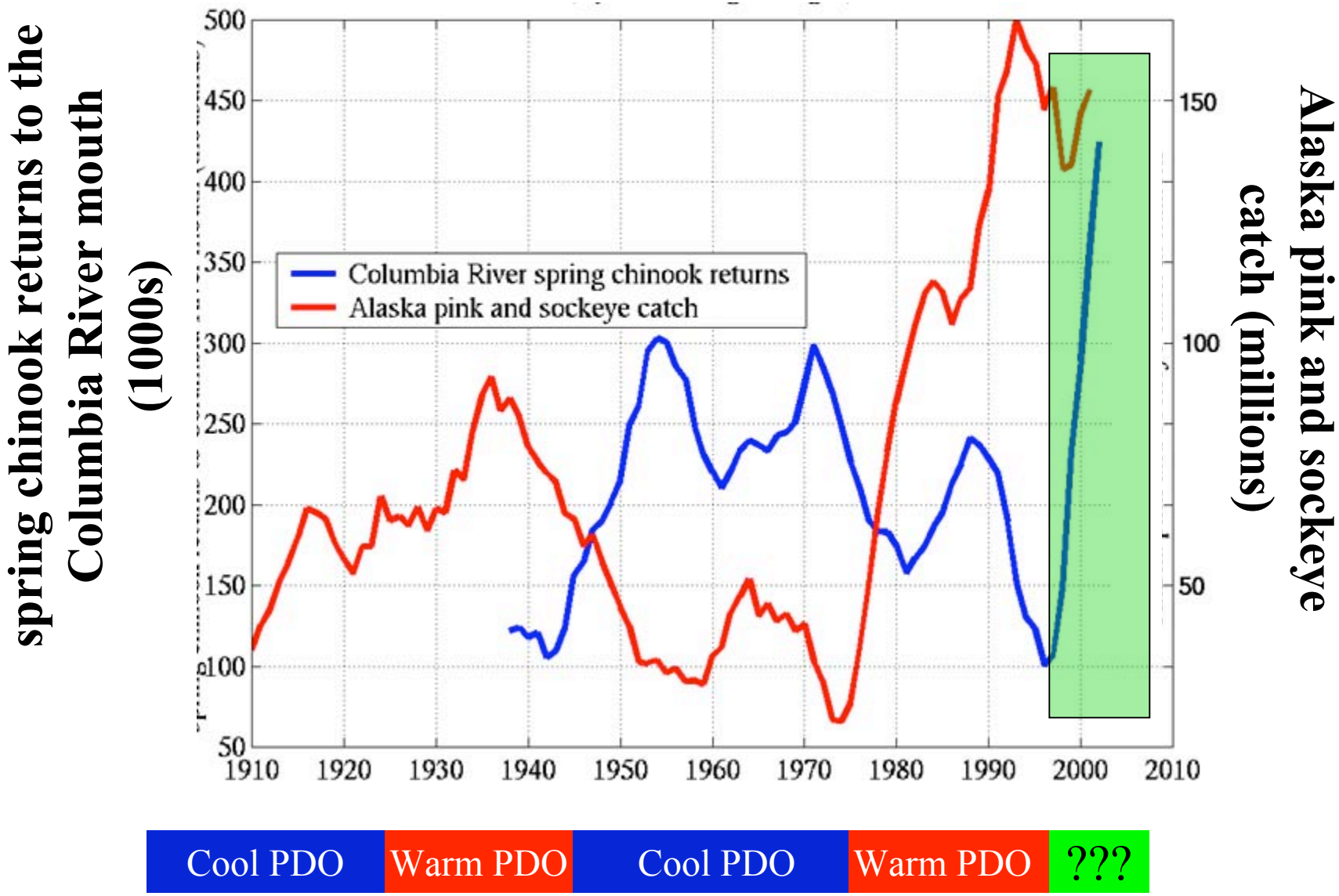
- We promote the use of climate information for salmon management by describing the research results at meetings and workshops … yet no managers want to use our results!

  The response from fishery management staff: "Your work is interesting, but it doesn't suit our needs"

- We partner with a NOAA fisheries scientist involved in salmon management to develop a forecast tool they can use

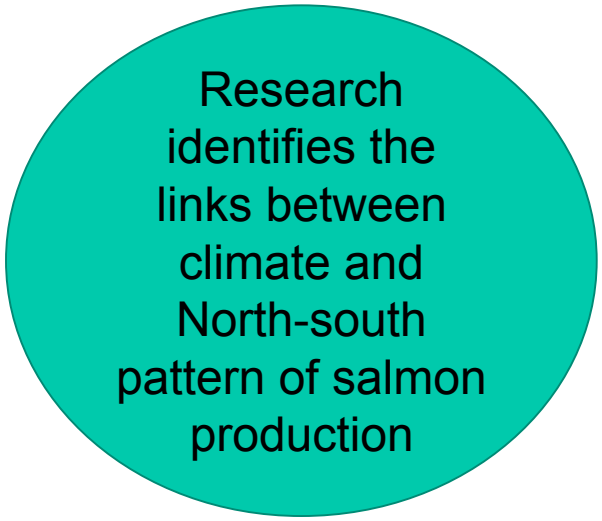
  In the process, we learn how to match the space-time scales of climate information with those of salmon management

A North-South see-saw in salmon production



Scale of research vs. scale of decisions

- PDO impacts on salmon across the North Pacific: large regional scales, multi-year fluctuations
- Annual stock specific management decisions

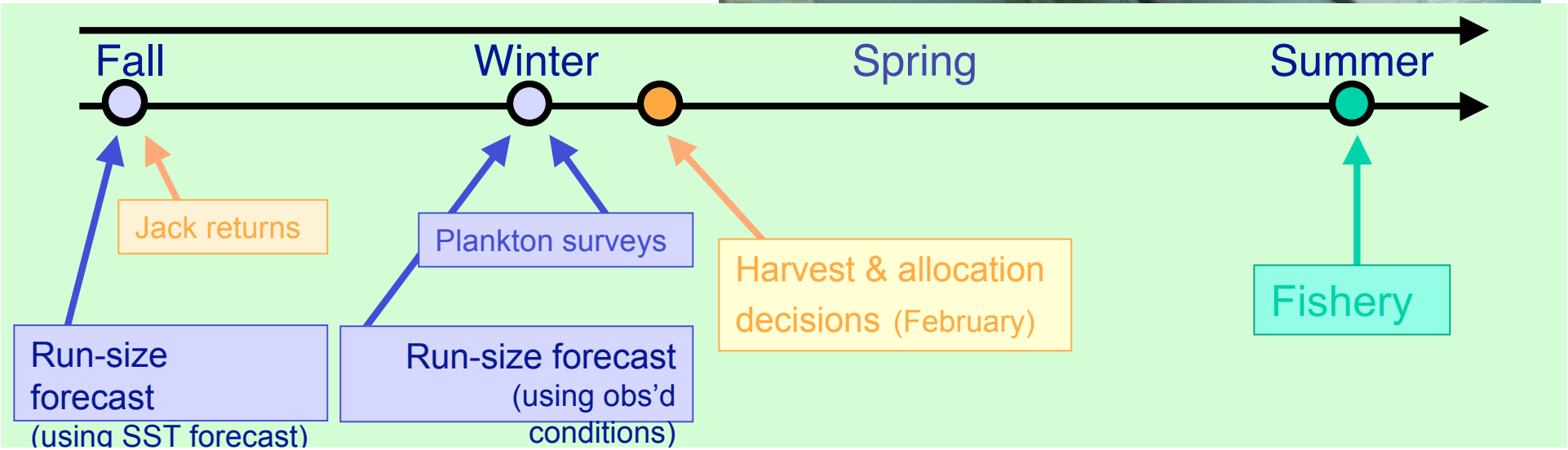


Annual management decisions made on a stock by stock (river by river) basis

Forecasting Salmon Returns

Coastal Ocean Conditions

- Sea surface temperatures
- Sea level
- Nearshore winds



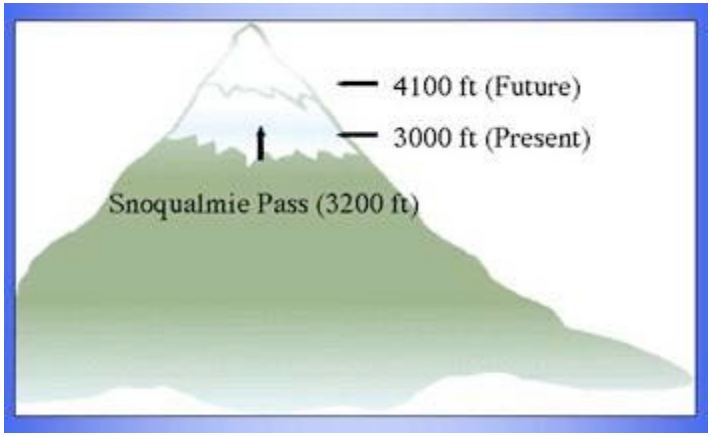
Decision-Support Tools: Climate Change

Designed to help managers evaluate and respond to projected climate change impacts. Research focused on the 2020s and 2040s. Main "products":

- Climate change impact scenarios
- Client-based research consultancies
- Climate change streamflow scenarios archive
- Technical planning assistance
- GIS mapping

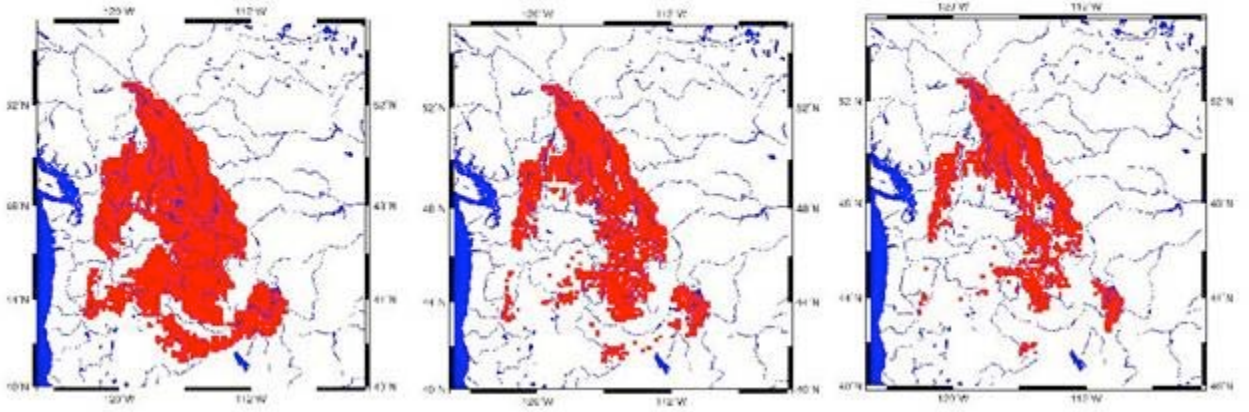
Main Impact: Less Snow

Changes in Simulated Snowpack



April 1 Columbia Basin Snow Extent

1950-1999 2020s 2040s

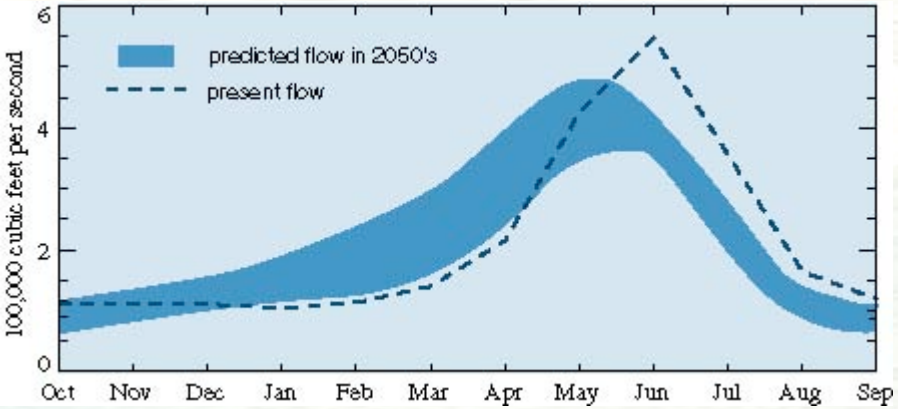


Hydrologic Changes

Less snow, earlier melt:

- More water in winter
- Less water in summer

- Increased winter flooding
- Increased spring/summer water temperature
- Decreased spring/summer flows for salmon
- Increased competition



Naturalized Columbia River flow - the Dalles, OR.

Climate change is in the "wrong" direction, given current conflicts and lack of adaptability, ESA listings, population growth...

The Problem: Different Tools Different Objectives

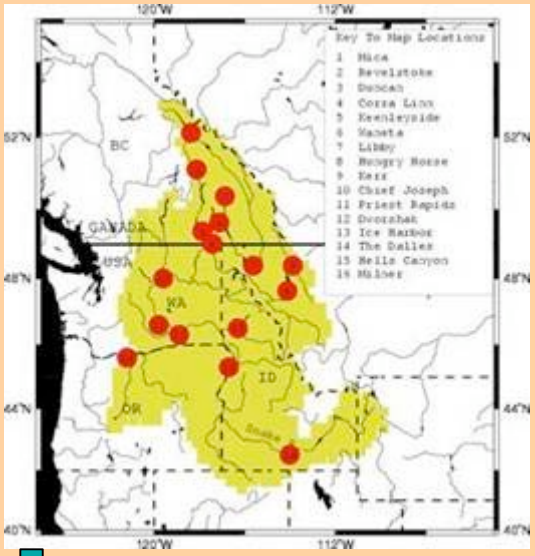
Climate research
Hydrologic studies
Integrated assessment
Adaptation strategies

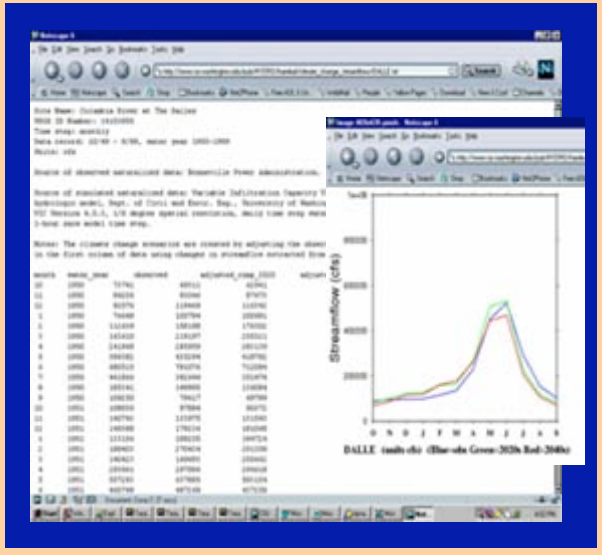
Formal planning exercises
Monitoring
Infrastructure
Water management

Climate Change Streamflow Scenario Tool for the Columbia River Basin

- Climate-adjusted streamflow data for 2020s and 2040s available on web site for 90+ locations in the Columbia River Basin

- **Benefit: Removes a barrier to climate impacts analysis. End user does not have to purchase, learn, and defend a new model to examine climate change impacts. Data can be used in existing planning models.**





Partners:

Northwest Power and Conservation Council

Idaho Dept of Water Resources

US Bureau of Reclamation

US Army Corps of Engineers

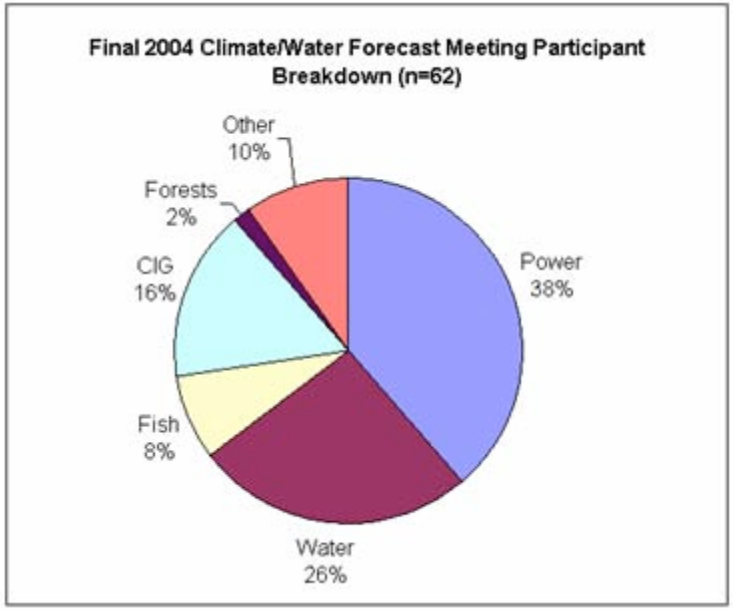
www.cses.washington.edu/cig/fpt/ccstreamflowtool/sft.shtml

Outreach

- Promotes regional understanding of climate impacts in PNW resource management. Activities include:
  - Workshops and meetings (4-5/year)
  - Presentations and briefings (75+/year)
  - One-on-one technical assistance (ex: watersheds)
  - Work with the local media
  - Web site development and maintenance
  - Graduate-level courses on climate impacts at UW
- Provides opportunity for feedback from the stakeholder community
- *Investment in outreach should not be overlooked. Interest in using climate information comes with increased understanding of impacts and research.*

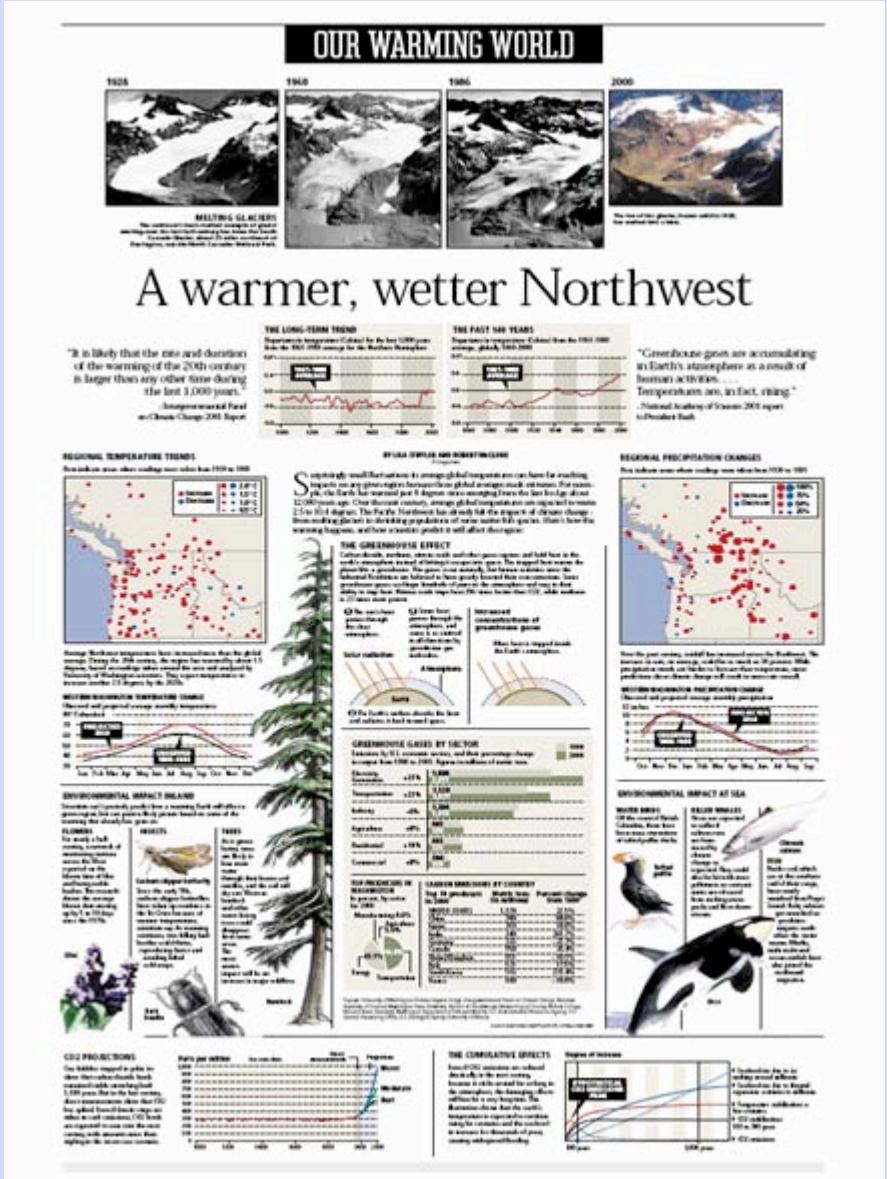
Meetings and Workshops

- Sector-specific meetings with technical resource staff and senior decision makers:
  - Fall climate and water forecast meetings (WA/OR and ID)
  - Climate and water policy meetings (2001, 2002)
  - Climate Impacts on Salmon Management and Recovery (CRB 9.21.04; Coast 2.04.05)
- 2005: expansion of salmon and coastal work



http://www.cses.washington.edu/cig/outreach/workshops.shtml

Work with the Media



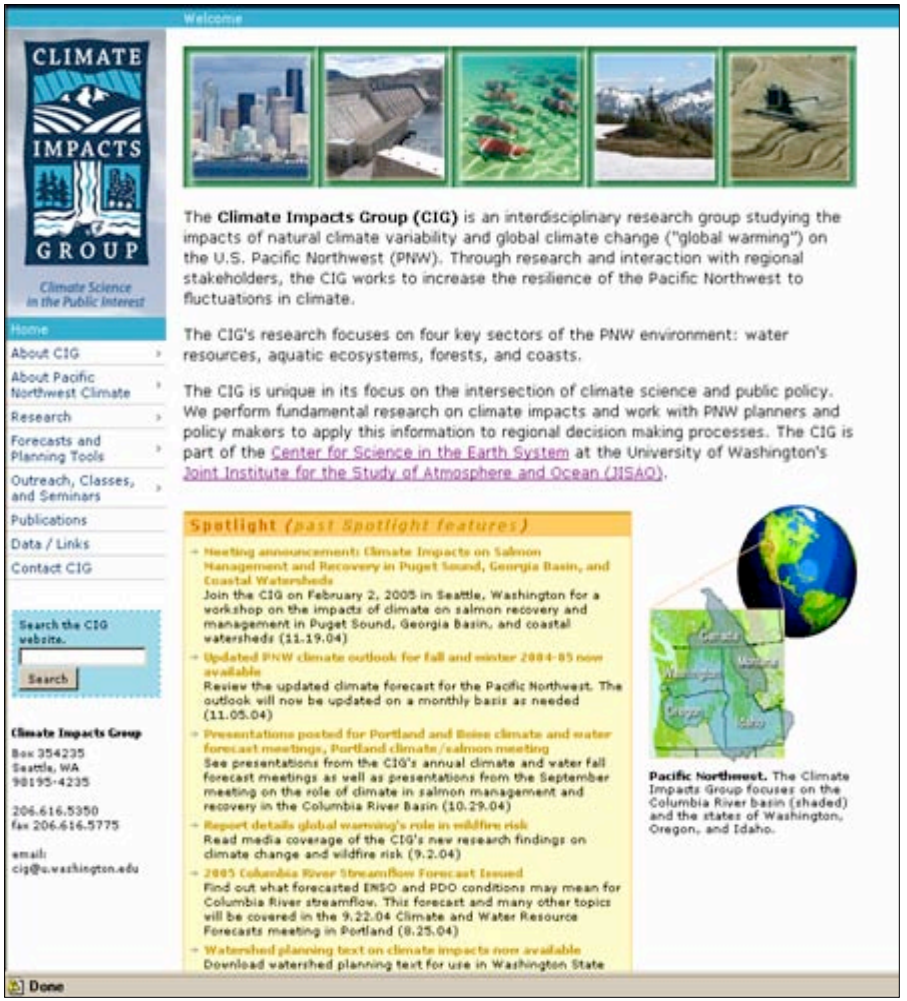
- Climate change workshop for the press, Nov. 8, 2001 (to be repeated ~2005)
- Hundreds of local and national news stories featuring CIG research, researchers since '97
  - Major Seattle PI special report on 11/13/03; 39 stories on web site
- Featured in KPLU (88.5 FM) climate change series, KZOK (102.5 FM) morning show
- Nate Mantua interviewed for 12/17/03 story on The NewsHour with Jim Lehrer

http://www.cses.washington.edu/cig/about/cignews.shtml

The New CIG Web Site

http://www.cses.washington.edu/cig

- Redesigned in spring 2004 to better serve as a planning resource
- An integral component of CIG decision support and outreach efforts
- Includes information on:
  - PNW climate and climate impacts
  - Forecasts and planning tools
  - Meetings and workshops
  - CIG publications



Work with Stakeholders

Benefits to CIG

Information about:

- **Use of climate forecasts by natural resources managers**
- **Perceived value of climate information**
- **Decision calendars**
- **Institutional constraints on adaptability**
- **Areas of vulnerability**

Benefits to Stakeholders

- **Tools for planning**
  - **Climate-based resource forecasts**
  - **Regional & resource-specific interpretations of global climate change**
- **Reliable and responsive source of information about climate outlooks and climate predictability**

Strategies

- **Continual networking to identify partnerships**
- **Workshops & surveys provide means for initial contact**
- **Capitalize on climate events**
- **Target all levels of decision making**
- **Demonstrate long-term commitment**

A Sea Change in Perceptions

Dramatic change in stakeholder perceptions of value and relevance of information about climate variability and change…

1995:
Few managers saw a role for climate information, recognized predictability of climate, or possessed a conceptual framework for applying climate information

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1997-98 (El Niño):
Media coverage of El Niño stimulated widespread interest in information about climate variability and in CIG

Most stakeholders unfamiliar with potential impacts of climate change and unprepared to use such information

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2001 (Severe Drought Year):
Senior-level water resources managers recognize climate change as a potentially significant threat to regional water resources; acknowledge climate change information as critical to future planning

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2001/2:
50-year drought brings intense media attention to issue and CIG's work ➡ public & private pressure on State agencies to include CC impacts in long-term planning ➡ significant involvement of CIG in multiple efforts

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2003/4:
Continued significant breakthroughs with stakeholder groups
2004/5: our latest (current) severe Drought Year

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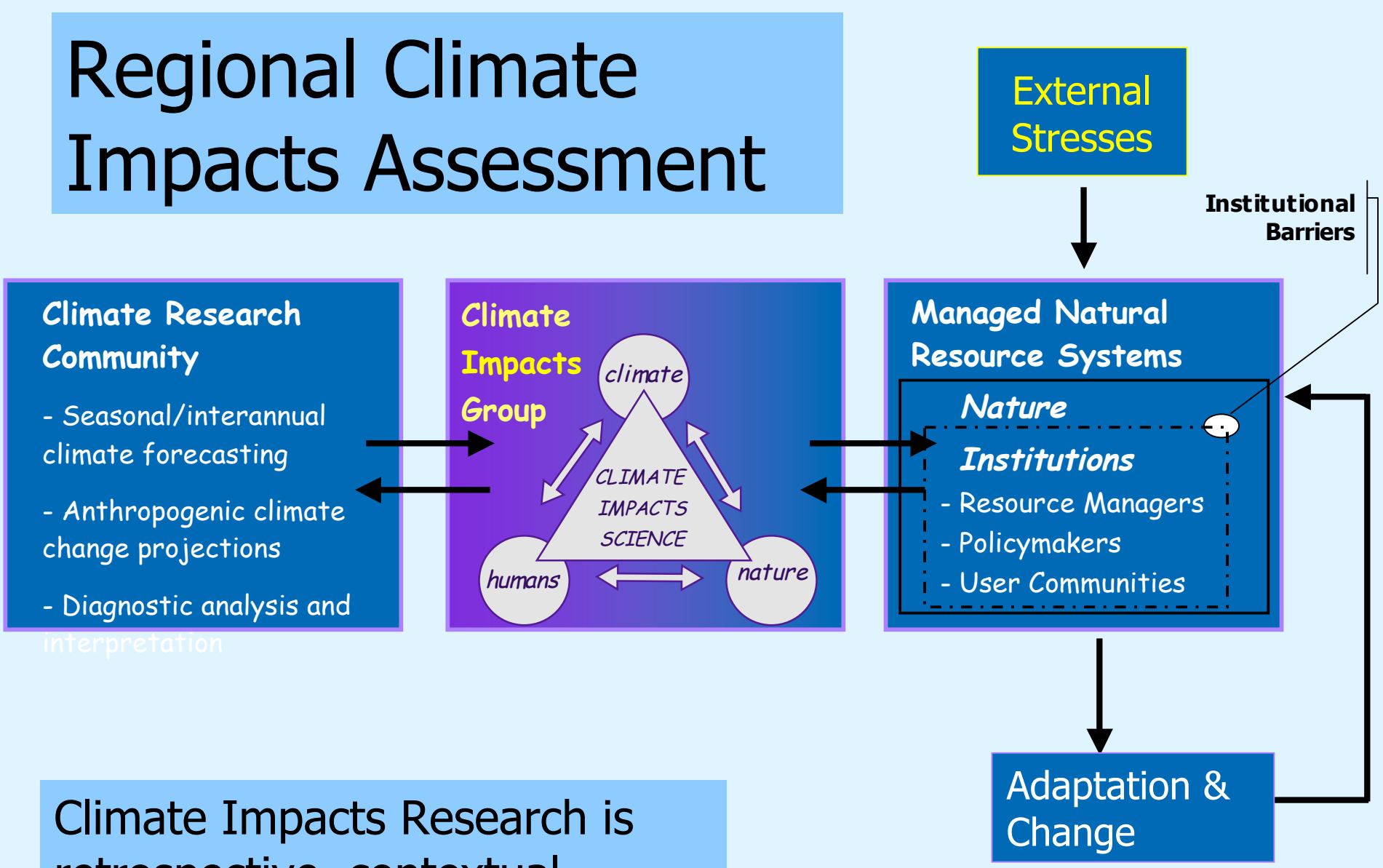
Influencing Operations and Policy

- Cultivated agency interest in planning for climate variability and change. Evidenced by:
  - New planning efforts specifically addressing climate impacts
    e.g., Portland General Electric, Idaho Water Department, Northwest Power and Conservation Council, West Coast Governors' Global Warming Initiative, King County
  - Strong attendance at meetings
    e.g., fall forecast, climate/salmon, hydrologic scenarios, climate and water policy meetings
  - Research partnerships and consultancies
    e.g., NOAA fisheries, municipal water suppliers, ID Dept of Water Resources, Northwest Power and Conservation Council, USACE, Bureau of Reclamation, Puget Sound Action Team
  - Requests for presentations (75+/year)

Impacts on Fisheries Science, Management and Recovery Planning

- **Information about PDO and ecosystem regime shifts percolating through Pacific fisheries management agencies**
  - International Pacific Halibut Commission, International Pacific Salmon Commission, North Pacific Fisheries Management Council, Pacific Fisheries Management Council, AK/WA/OR Dept's of Fish and Wildlife
- **Collaboration on climate and coho life cycle studies with NWFSC and AFSC**
  - 4 paper series led to formal collaboration arrangement with NWFSC
  - Proposed NOAA/NWFSC initiative on climate change and freshwater ecosystems (CIG, NWFSC, U. Idaho)
  - WA Dept. of Fish and Wildlife salmon management changed to recognize climate uncertainty
- **Ongoing collaboration with Col. Riv. Intertribal Fish Commission**
  - CRITFC developed proposed alternative Col. Riv. operating plan based on CIG's streamflow projections
  - Current PhD work on chinook salmon
- **NWFSC's Oceans and Human Health Initiative collaboration**
- **Pilot study of climate change and Snohomish R. salmon recovery planning with NWFSC**

Regional Climate Impacts Assessment



Climate Impacts Research is retrospective, contextual, interdisciplinary & integrated

Implications for the Transition to Operational Climate Services in the PNW

- Developing the institutional capacity to provide climate services is neither quick nor easy. Requires:
  - Defining the types of climate information that are most useful for the specified applications
  - Producing very specific, mutually defined products
  - Building trust with stakeholders over time
  - Developing an integrated research and outreach team for continued innovation
- The successful delivery of climate services requires the establishment (and maintenance over time) of a middle-man between the providers and users of climate information
  - Must have research and interpretive/outreach arms, e.g., climate extension service
  - Individual agencies and industries assume operational responsibilities only after products are developed, tested, and demonstrated

Supporting Adaptation Through….

- **…Research**
  - Investigating sensitivity and vulnerability to climate variability and change
  - Provides the foundation for decision-support and outreach activities
- **…Decision-support tools**
  - Designed to facilitate use of climate information in operations and planning
- **…Outreach**
  - Designed to develop (and maintain) ongoing relationships with the stakeholder community

Mt Baker, WA

Photo: Chris Keane American Geological Institute

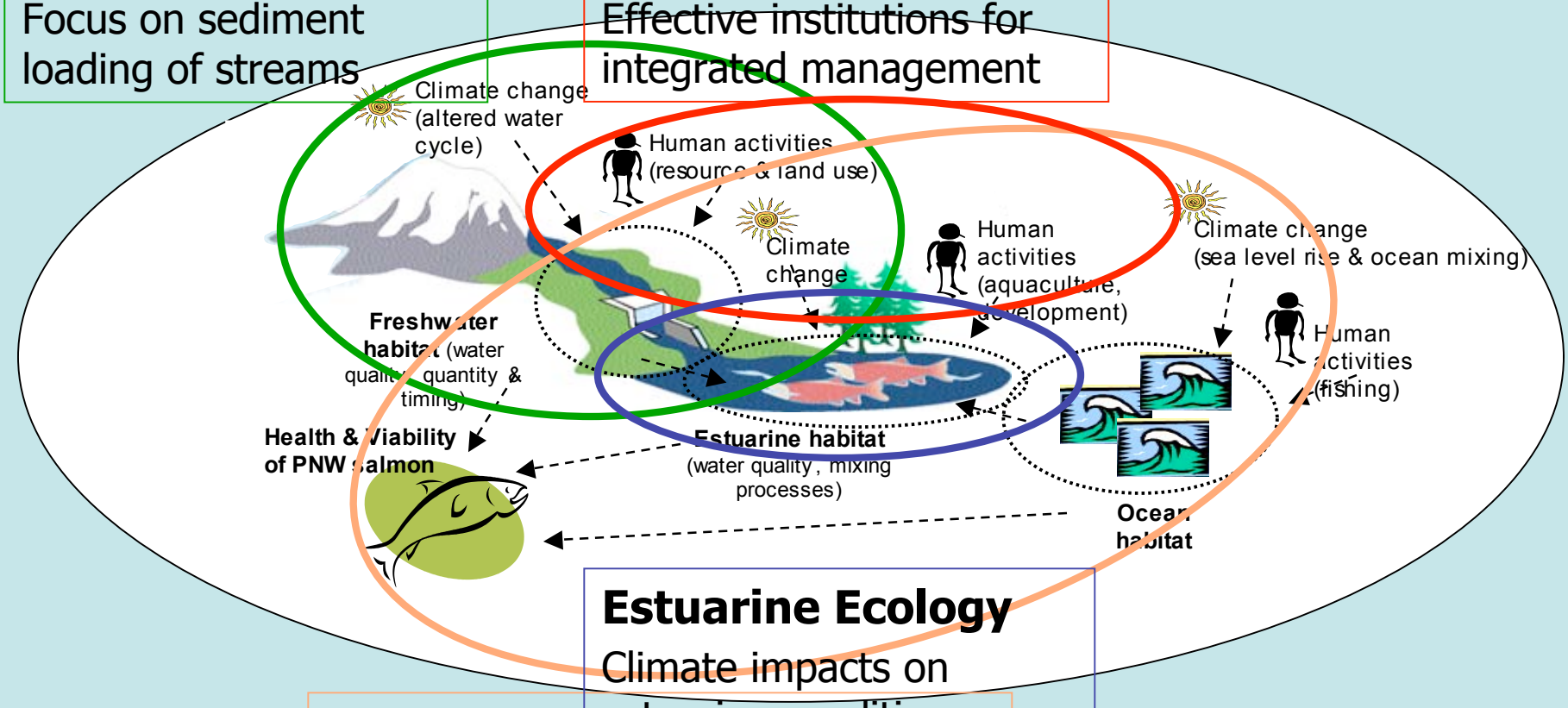
Integrated Watershed Analysis

Responding to stakeholder demand for information applicable to real-world watershed planning issues.

Integrated Watershed Analysis

Forest Hydrology
Focus on sediment loading of streams

Coastal Management
Effective institutions for integrated management



Estuarine Ecology
Climate impacts on estuarine conditions

Salmon Lifecycle
Relationship between habitats and salmon success

In Summary

- CIG strives to help the region develop the capacity to adapt to climate variability and change via:
  - Basic and applied research
  - Development of decision-support tools
  - Outreach
- Decision support and outreach efforts have been instrumental in developing and maintaining productive working relationships with the stakeholder community
- Demand for CIG's research and products continues to grow, and CIG will continue to respond to these demands.